Annex III

Uruguay

TC-0004017-UR

Terms of Reference - Subprogram "A"

INTEGRATION OF SURVEY PLATS TO SPATIAL DATABASE
FOR INFRASTRUCTURE PLANNING

I. PROJECT OBJECTIVES

1.1 The *Ministerio de Transportes y Obras Públicas* (MTOP), through the *Dirección Nacional de Topografía* (DNT), has been implementing a National Clearinghouse of Geographic Data (NCGD) as part of its efforts to consolidate a National Geographic Information System (NGIS). Apart from developing and implementing the system, designed with the aim of making spatial data widely available to the country, the project has also converted to digital format a significant portion of plani-altimetric information, including 1:200.000 and 1:50.000 scale topographic maps of the country.

1.2 The proposed project builds upon, and strengthens, on-going development of a National Clearinghouse of Geographic Data, and the development, dissemination and use of spatial digital data through integration of parcel and property data and application developments. These databases and tools will support infrastructure planning, development and management responsibilities among the participating directorates at MTOP and other public agencies.

1.3 The Clearinghouse is a distributed network, electronically connected, of producers, administrators and users of geographic information. Since 1997, the databases have public access through the Internet. The central node of the Clearinghouse resides at MTOP's headquarters in Montevideo, and DNT provides the general coordination for the current ten agencies collaborating in this effort. An operator is contracted for daily operations and maintenance, and for processing inquires and data delivery. Users pay transaction expenses and fees, as a mechanism to provide financial sustainability for NCGD's operations.

1.4 The Project will support the ability of the DNT to enhance capabilities and to develop specific applications that will primarily strengthen the specific analytical and decision making requirements of the *Dirección Nacional de Vialidad* (DNV). In addition, application development support will be provided to the *Dirección Nacional de Catastro* (DNC), including specific GIS user training.

1.5 The DNT has converted a significant amount of needed spatial data to digital format and established the backbone of a National Spatial Data Infrastructure (NSDI). The present development focus is on enhancement and expansion of spatial databases through conversion of considerable existing cartographic property data from multiple sources and scales.

1.6 The specific information responds to the infrastructure management and planning needs countrywide, and includes: property maps and attribute data which presently lack cartographic control for use in GIS. These data are fundamental for planning transportation and related infrastructure in both urban and rural areas.

1.7 This initiative provides further consolidation of databases and applications to contribute to other sectors such as health, education, environment and natural resources countrywide, all of which will benefit from the availability and coordination of cadastral information and spatial data.

1.8 Strengthening of the GIS system will contribute to the understanding of socioeconomic consequences of highway projects and of other infrastructure projects, including ones which the bank is presently involved. Furthermore, the systems, databases and applications will provide the MTOP and the Bank with additional analytical tools and spatial data to support the studies of integration corridors. The tools and methodologies being developed for Bank supported GIS projects in Uruguay and other countries will be incorporated into this project.

1.9 This Technical Cooperation project has two subprograms. This Subprogram "A" includes the participation of the *Dirección Nacional de Catastro* and focuses on the conversion and digital integration in the National Clearinghouse of Geographic Data of approximately 50,000 microfilms of survey plats that form the base for the national cadastre. These are archived in the *Dirección Nacional de Topografía*. The availability and dissemination of the new digital database will enhance infrastructure management, planning and decisions by the project participants.

A. Scope of Work

1.10 A consulting firm will carry out the tasks of the program supported by this Technical Cooperation. The consulting firm must have expertise in developing solutions for transportation and environmental planning, and with capabilities and experience in spatial data conversion and GIS applications design and development.

1.11 The scope of work will be carried out by the consultant, in coordination with the *Dirección Nacional de Topografía* (DNV) and with the *Dirección Nacional de Catastro*, (DNC).

1.12 A supervisory consultant will also be hired by MTOP to provide the required analysis of the reports, evaluate the products delivered, and coordinate with local counterparts. The supervisory consultant will also provide support and coordinate

with the Bank's staff (COF/CUR and RE1/FI1) in the task of integrating this Project with other GIS-related projects in Uruguay and in the Region (Perú, Bolivia, Chile and Argentina).

1. Description of Tasks

a) Digitize (scan) parcels from existing survey plat microfilms,

1.13 This task consists of digitizing (scanning) parcels from existing survey plat microfilms. The resulting digital will be georeferenced with the corresponding parcel identification numbers for integration to the GIS database. Property survey plats are originally generated by the *Dirección Nacional de Catastro*. The *Dirección Nacional de Topografía* maintains microfilms of existing survey plats countrywide. A sample of approximately 50,000 microfilms of survey plats will be digitally converted and integrated to the GIS database in order to develop prototype analyses and applications in a rural sample project area comprised of San José, Canelones and Colonia Departments. This task will also develop procedures and methodologies for conversion and integration to the GIS database countrywide, and develop procedures for automatically updating changes related to the survey plats, in the GIS database, when they occur in the future.

1.14 Existing microfilms of parcel survey plats will be scanned and digitally georeferenced to the base-map control layer established in DNT's GIS. Attribute tables will be developed for each parcel that will include all node coordinate values defining the parcel, all identification numbers corresponding to the parcel, and any other attribute information related to the parcel and available from the microfilm archives.

b) Create polygon topology to the georeferenced parcels in the project analyses areas and construct parcel layer in the GIS.

1.15 The georeferenced parcel survey plats will be topologically joined to construct a parcel layer covering San Jose, Canelones and Colonia Departments (the project sample area), in the GIS database.

c) Georeference highway layout and develop GIS buffer algorithms for project analysis areas.

1.16 These analyses will be applied to the sample project area comprised of San Jose, Canelones and Colonia Departments. Source materials will be provided by DNT. The road networks, including both national and rural roads, will be georeferenced to the control layer established in the DNT geographic information system database. The buffer algorithms will be developed for ArcInfo and ArcView GIS and will allow users to select and vary the buffer distances from selected highways or other features.

d) Develop prototype application for creating union of parcels

1.17 Prototype application for creating union of parcels and highways will be developed in order to calculate valuations of affected parcels for expropriation or acquisitions applications. Using the spatial data developed in Task "c" (georeferenced highways with buffers), and Task "a" (geofererenced survey plats/parcels), applications will be developed to create union of parcels and highways to calculate affected parcels and areas for expropriation/acquisition type analyses.

1.18 When overlaid with other spatial data layers, for example highways or proposed linear rights-of-way and parcel maps, the buffer analysis should automatically generate listings and displays of parcels within the buffer areas.

e) Incorporate land values from parcel appraisals to benefit infrastructure-planning studies.

1.19 In this task land values should be incorporated from parcel appraisals to benefit infrastructure-planning studies. Land values from available and most recent appraisals (valuations) shall be acquired from appropriate source(s) and associated with the proper parcel for GIS applications of benefit to infrastructure planning. In order to properly associate the appraisal values with the respective parcels, the appraisal values should be an attribute directly linked to each respective parcel. The attribute must include the date of the appraisal, and permit recording the history or lineage of appraisals for each respective parcel. Procedures for integrating land valuations for each parcel in the GIS database will be developed and documented, and implemented for all parcels in the sample project areas, as georeferenced from survey plats in Task “a”.

f) Create GIS applications to automatically generate expropriation plans and updates of the cadastral database.

1.20 The procedures developed for survey plat conversion (Task “a”), creation and updating of a georeferenced and topologically correct parcel layer in the GIS (Task “b”), integration of land valuation for each parcel (Task “e”), development of buffer algorithms (Task “c”) and applications for expropriation (Task “d”) and infrastructure planning (Task “e”) will be integrated to create a GIS application to automatically generate expropriation plans and update of cadastral databases.

1.21 The GIS application must specify database requirements and procedures, integrate and automate analysis procedures for expropriation or acquisition planning and analysis, and provide the appropriate updating to the cadastral and related databases at each step of the expropriation or acquisition planning process.

g) Coordinate this project with other GIS-based projects.

1.22 This project will develop databases and applications that must be coordinated and compatible with other GIS-based projects in Uruguay and throughout the region,

specifically in the Mercosur area of influence. In particular, the program named "Spatial Information System for National Infrastructure Management and Planning (TC-9811911-UR) requires access and use of the databases to be developed in the Conaprole sample project area.

h) Seminars, training and workshops

1.23 This project will provide seminars, training and workshops with participants from all participating directorates, institutions, and other government agencies.

1.24 A Project Seminar should be planned at the beginning of the project with those participants within MTOP (DNT, DNV, etc.), DNC, and others as appropriate, to explain each aspect of the project, discuss the procedures, expected applications and products, training plans, etc.

1.25 Project Workshops are designed to promote, through presentations and demonstrations, a common understanding of the benefits and advantages of GIS for updating, maintenance, and analysis of cadastre and related databases, particularly for infrastructure planning and analyses, including expropriation and acquisition planning and analyses.

1.26 Training will be required for GIS users of the databases, applications, and GIS tools developed in the project. Forty (40) hours of hands-on training will be provided to a group of up to 10 professionals from the MTOP and up to 5 professionals from DNC. Training must also include fundamental GIS concepts and procedures, provide hands-on experience, and the necessary understanding of how the spatial databases developed and the tools being provided can support the activities of all participating directorates.

i) Hardware and software for microfilm scanning.

1.27 The consulting firm shall provide DNT with a digital scanner for the conversion of microfilm images. The scanner shall provide zoom capabilities of al least 7X and 9.5 to 16X, and interface to a PC. In addition, the consulting firm shall provide a Pentium server, with a minimum of: 1Ghz processor with 256 RAM and 30GB hard disk, running under the Window NT 2000 operating system, with 3 licenses. Also, a "hot pluggable" external 36GB disk tower supporting a minimum of 12 disks of 1" shall be acquired to support storage of the scanned images. Besides, a GIS workstation with software upgrade license shall be acquired to support the cadastral databases and application development activities.

1.28 All hardware acquired by the consulting firm for this program, as specified in these Terms of Reference, shall be formally donated to MTOP not later than the end of the project. Furthermore, any software licenses paid by the Consultant for the purposes of this project, as specified in these Terms of Reference, shall be registered in the name of MTOP.

j) Terms of Reference for subsequent needs or phases.

1.29 This task deals with the identification of subsequent needs and preparation of the corresponding Terms of Reference, including those for interface to the property registry. Terms of Reference will be developed to allow for identification of further enhancements to the databases, applications, procedures, and systems that may be incorporated into other Bank supported projects. As procedures and cadastral databases are integrated into GIS applications and analyses, procedures must also be developed in the future for interfacing to the property registry in a manner to permit interchange of transaction-based updates to the cadastre.

II. PRODUCTS AND SERVICES

2.1 The products and services described in this section are part of the deliverables. All reports shall be presented to the beneficiaries and to the Bank for review in a total of ten copies in both hard copy and digital format, three to the Bank and seven to the beneficiaries.

A. Reports

2.2 There will be two reports prepared in the course of the project.

a. **Applications Design Report.** This report will include the technical specifications of the applications to be developed. Also, to be included in this report are the Data Dictionary and Metadata information to be developed for the digital data produced.

b. **Final Report.** The Final Report will include a description of activities carried out during the development of the project, the Terms of Reference for subsequent phases, together with an analysis from the seminars and workshops, and recommendations for any other future activities. The final report will include all materials prepared during the course of the project.

B. Databases

2.3 The following databases will be compiled:

a. Spatial data compiled in Task “a”, digitized (scanned) parcels from existing survey plat microfilms, georeferenced with corresponding parcel identification numbers for integration to the GIS

b. Database of land values from parcel appraisals compiled in Task “e”.

C. Applications

2.4 The study will include the following applications:

a. Applications to combine buffer layers to calculate values of affected areas of analysis (Task “c”)

b. Prototype application to calculate values of affected parcels in expropriation/ acquisition analyses (Task “d”)

c. Applications to automatically generate expropriation plans and update cadastral database (Task “f”)

D. Hardware and software

2.5 The consulting firm will provide the following hardware and software:

a. Digital scanner for microfilm image conversion.

b. Pentium server and hot plug disk tower for image storage.

c. GIS Workstation with software licenses.

d. Data compression software with license (Mr SID or equivalent).

E. Training and other materials

2.6 The consulting firm will provide the following training and other materials.

a. **Training Materials.** All training materials utilized for the various seminars, training and workshops should be delivered in the original format. A set of training materials should be provided to each participant in each training course and three sets of training material in both hard copy and digital format should be provided to the Bank and seven sets to the beneficiaries.

b. **Data Dictionary and Metadata**. A Data Dictionary must be developed with the listing of all data written to CD-ROM and with Metadata information for the digital data produced by the consultant (12 sets of Data Dictionary and Metadata in both hard copy and digital format will be provided to both the Bank -five sets- and the beneficiaries –seven sets-).

F. Ownership and Copywrights

2.7 All reports and relevant data such as maps, diagrams, plans, statistic and supporting data acquired, compiled or prepared in the course of services provided by the consulting firm shall be confidential and shall be the absolute property of the Bank. The Bank grants the beneficiaries the right to use, distribute and disseminate the results, data and any other product resulting from this technical cooperation. Also, the Bank, and to the extent permitted by the vendor, will own the copyright to any spatial data created or acquired for use in the project, including the right to reproduce, distribute, disseminate and publish the same. Again, the beneficiaries have the right to use and disseminate these products.

2.8 All existing applications and relevant data previously developed or licensed to the MTOP as beneficiary, and required for the purposes of this program, will remain the absolute property of the beneficiaries. The beneficiary grants the Bank permission for using these databases and applications in projects of regional integration and for other justified purposes within the normal businesses conducted by the Bank, upon previous written notification by the Bank.

2.9 The Bank will also own the copyright of programs written to implement all applications except for existing previous applications already developed by the Consulting Firm or the beneficiary. The beneficiaries are granted permission to use these applications, but their right will be limited to using the application in similar GIS projects if specifically stated in the consulting firm technical proposal. The Consulting Firm may retain a copy of such materials but may not use the same for purposes unrelated to this contract without prior written permission from the Bank.

2.10 As a mean of maintaining an updated inventory of databases within the Clearinghouse (NCGD), the Bank will notify MTOP when the digital databases developed with this program are use, updated or modified for projects in Uruguay with other public agencies and institutions, or for purposes of planning regional development projects.

III. QUALIFICATIONS OF CONSULTING FIRM AND CONSIDERATIONS FOR THE TECHNICAL PROPOSAL

3.1 Given the nature of the work, the Consulting Firm must have extensive expertise and familiarity in the development of GIS applications and in the digital conversion of spatial data for GIS applications to Regional Transportation and Infrastructure Management.

3.2 The Consulting Firm will allocate the personnel necessary for the successful completion of the project in accordance with the methodology, work program and staff allocation, which will form part of the proposal. As such, it is the exclusive responsibility of the Consulting Firm to determine the specialties and timing of professional and technical personnel to be used.

3.3 In the Proposal the Consulting Firm should give special attention to the following items:

a. Seminars, workshops and training—provide descriptions of the format of the seminars and the approach to the training environment.

b. Digital Data—indicate understanding of the existing data to be used in compiling the digital spatial data and discuss the methodology for developing the spatial databases (specifying hardware, software, data sources and procedures to be used).

c. Map projection and referencing system—provide an understanding of the issues of having different sources of spatial data, including microfilm survey plats, and utilizing different map projections and different referencing systems.

d. Quality Assurance and Quality Control—describe issues of quality of the spatial data being compiled and of applications to be developed and describe how QA/QC will be incorporated into the project. As part of the discussion of quality control of the spatial data indicate any metadata and cartographic standards that shall be followed.

e. Spanish—all reports and other materials shall be produced in Spanish. The consultant may provide additional versions or copies in English. An executive summary of the Final Report shall be produced in Spanish and English.

f. Budget—the proponent must provide a budget broken-down by tasks.

IV. DURATION OF PROJECT

4.1 The work should be conducted in a period of no longer than 12 months.

V. REPORTING RELATIONSHIPS

5.1 The supervision of the study by the Bank will be the responsibility of the Country Office in Uruguay (CFO/CUR) in coordination with and technical assistance from the Finance and Basic Infrastructure Division 1 (RE1/FI1).

5.2 The supervisory consultant hired with funds from this Technical Cooperation will assist the Bank and MTOP in the analysis of the reports, evaluate the products delivered, and coordinate with local counterparts. Also, the supervisory consultant shall coordinate with COF/CUR and RE1/FI1 in the task of integrating and making this project compatible with other GIS-related projects financed by the Bank in Uruguay and in the Region (Perú, Bolivia, Chile and Argentina).